Application No.: 09/914,456
Filed: August 28, 2001
TC Art Unit: 2624
Confirmation No.: 5339

REMARKS

The foregoing Amendment is filed in response to the official action dated March 31, 2006. Reconsideration is respectfully requested.

The status of the claims is as follows:

Claims 1-30 are currently pending.

Claims 1-30 stand rejected.

Claims 1, 11, 14, 23, and 27 have been amended.

Claims 31-35 have been added.

The Examiner has rejected claims 1-30 under 35 U.S.C. 103(a) as being unpatentable over Williams *et al.* (USP 6,199,986) in view of Neal *et al.* (USP 6,547,395) and further in view of Evans *et al.* (USP 5,739,906). The Applicants respectfully submit, however, that base claims 1, 11, 14, 23, and 27, as amended, recite non-obvious subject matter that distinguishes over the art of record.

For example, amended claim 1 recites a process for noise reduction from noisy data representing an artifact at sample points in two dimensional space of a wafer specimen, including receiving the noisy data as a vector, each element of which corresponds to one sample point, and calculating coefficients of a polynomial which converts the noisy data vector to a two dimensional function continuously representing the artifact in the

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two dimensional space, in which the noisy data is obtained using a wafer measurement apparatus, the noise being induced in the noisy data by movement of the wafer specimen within the wafer measurement apparatus, and in which the calculating step includes mathematically multiplying the data vector by a matrix representing a noise characteristic of the wafer measurement apparatus to achieve the noise reduction from the noisy data. Such a process of achieving noise reduction from noisy data, in which the noise is induced in the data by movement of the wafer specimen within the wafer measurement apparatus, is described throughout the instant application, for example, see page 3, line 12, to page 4, line 18, page 9, lines 9-14, and page 10, lines 3-7, of the application.

The official action indicates that the Williams reference discloses performing noise (aberration) reduction on noisy data from an eye. The Applicants respectfully submit, however, that the wavefront aberrations disclosed by Williams *et al.* do not correspond to noise induced in the noisy data by movement of the object being measured, as recited in amended claim 1, but instead correspond to aberrations caused by a scar or the like in the eye (see, *e.g.*, column 2, lines 8-11, and column 4, line 19, of Williams *et al.*). As recited in new claim 31, such movement of a

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wafer specimen within a wafer measurement apparatus may comprise a circular rotation of the wafer specimen.

The official action further indicates that the Neal reference provides teachings where wavefront measurement is used for analyzing the surface of hard disk platens, wafers, and the human eye, and acknowledges that a shape of the object under measurement can be determined using wavefront measurement interferometers. The Applicants respectfully point out, however, that although the Neal reference relates to making measurements of wafers that are moving, *i.e.*, rotating, (see column 5, lines 2-4, of Neal *et al.*), the Neal reference neither teaches nor suggests mathematically multiplying a data vector by a matrix representing a noise characteristic of the wafer measurement apparatus to achieve a reduction in noise, which is induced in the data by such movement of the wafer specimen. In fact, the approach taken by Neal *et al.* for measuring a rotating wafer is significantly different from the process recited in amended claim 1. For example, instead of mathematically multiplying a data vector by a matrix representing a noise characteristic of the wafer measurement apparatus, as recited in amended claim 1, the Neal reference discloses a technique that employs a pulsed light source with a wavefront sensor to obtain "snapshot" images of the moving wafer specimen

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(see column 5, lines 10-12, and column 6, lines 22-24, of Neal *et al.*). The Neal technique then performs wafer measurements using the snapshot images, which depict an effectively stationary wafer specimen.

In addition, the official action indicates that the Evans reference discloses the use of a wavefront measurement using interferometers to determine a wafer thickness measurement, and the calculation of Zernike coefficients of a polynomial to represent the wafer bow (noise) in a two-dimensional representation. The Applicants respectfully point out, however, that like the Williams reference, the wafer bow (noise) disclosed by Evans *et al.* does not correspond to noise induced in the noisy data by movement of the wafer being measured, as recited in amended claim 1, but instead corresponds to a physical deformation of the wafer. In fact, in the Evans measuring apparatus, the wafer being measured is restrained from movement by being secured in the cavity of the interferometer, which performs the wafer measurements (see column 7, lines 14-16, of Evans *et al.*).

Because neither the Williams reference nor the Evans reference discloses noise reduction from noisy data, in which the noise is induced in the data by movement of the object (*i.e.*, a semiconductor wafer) being measured within the measurement

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apparatus, and because neither the Williams reference, the Evans reference, nor the Neal reference discloses performing such noise reduction by a process that includes mathematically multiplying a data vector by a matrix representing a noise characteristic of the measurement apparatus, the Applicants respectfully submit that the combined teachings of the Williams, Evans, and Neal references would not suggest to one of ordinary skill in this art the subject matter of amended claim 1 and the claims dependent therefrom. For at least the reasons discussed above with reference to amended claim 1, the Applicants further submit that the suggested combination of the Williams, Evans, and Neal references would not render amended base claims 11, 14, 23, and 27 and the claims dependent therefrom obvious.

By providing a process for noise reduction from noisy data representing an artifact at sample points in two dimensional space of a wafer specimen that includes performing a transform on a data vector using a matrix representing the noise characteristic of a wafer measurement apparatus, the noise induced by movement of the wafer specimen within the wafer measurement apparatus can be reduced or eliminated (see page 5, lines 24-30, of the application). The art of record neither teaches nor suggests such an advantage.

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Accordingly, it is respectfully submitted that the rejections of claims 1-30 under 35 U.S.C. 103 should be withdrawn.

The Applicants have added claims 31-35 to recite more distinctly embodiments of the present invention. It is respectfully submitted that new claims 31-35, which are supported by the disclosure of the instant application as originally filed, recite non-obvious subject matter that distinguishes over the art of record.

In view of the foregoing, it is respectfully submitted that the present application is placed in a condition for allowance. Early and favorable action is respectfully requested.

The Examiner is encouraged to telephone the undersigned Attorney to discuss any matter that would expedite allowance of

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the present application.

Respectfully submitted,

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